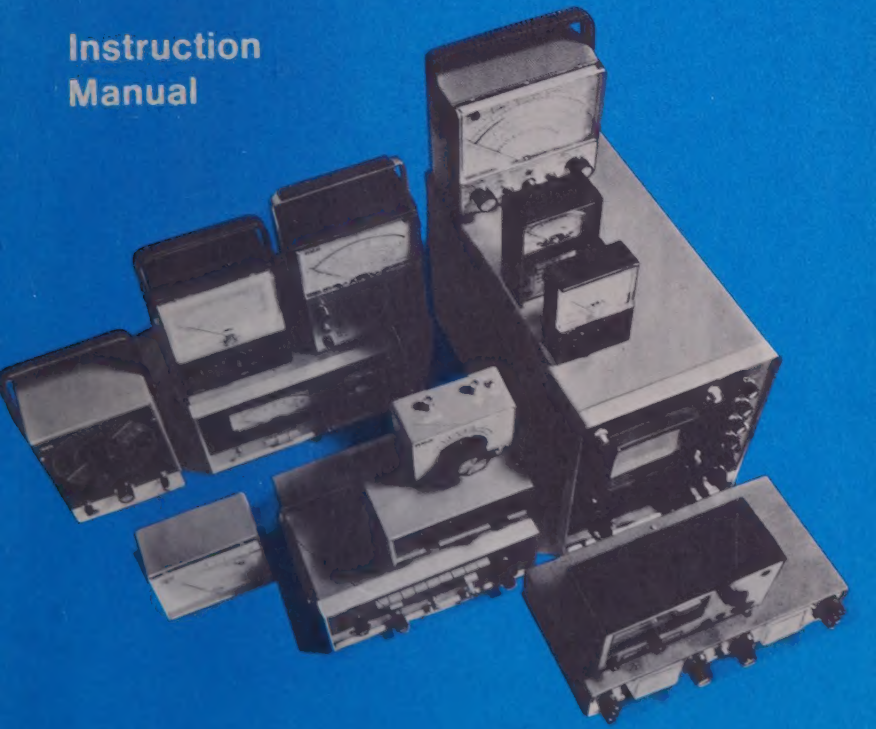
Function Generator
WR-550A

Instruction Manual



VIZ Test Instruments

VIZ Mfg. Co. 335 E. Price St. Phila., Pa. 19144

Price $1.00

SAFETY PRECAUTIONS

Be careful whenever testing electrical equipment that is operating from an AC power line or other high voltage source. There is always the danger of electrical shock from these circuits. You should become familiar with the equipment before making tests. Keep in mind that voltages may appear at unexpected points in defective equipment.

It is good practice to remove power before connecting test leads to high voltage points. When measuring high AC or DC voltages, do not touch the panel or test leads. Also, it is important to use an isolation transformer such as the VIZ WP-25A, WP-26A, or WP-27A Isotap when working with AC/DC equipment where the chassis is connected to one side of the AC power line.

PATENT STATEMENT

Information furnished by VIZ is believed to be accurate and reliable. However, no responsibility is assumed by VIZ for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of VIZ.

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DESCRIPTION

The VIZ WR-550A Function Generator is a compact, light weight, easy to use, solid state signal source.

Available on the front panel are three output terminals:

a. A fixed amplitude Squarewave jack, —.2V to +4 VDC which is TTL compatible.

b. A fixed amplitude Trianglewave jack, 4V pp centered around 0 volts DC.

c. Switch selectable output terminals, with variable amplitude Squarewaves, Trianglewaves or Sinewaves, with 0 to 20 V pp capability. These output terminals have continuously adjustable ±10 VDC offset (front panel "Level" control) and will drive 5 Vpp into 50 ohms (nominal output impedance is 600 ohms, for the Squarewave or Trianglewave forms).

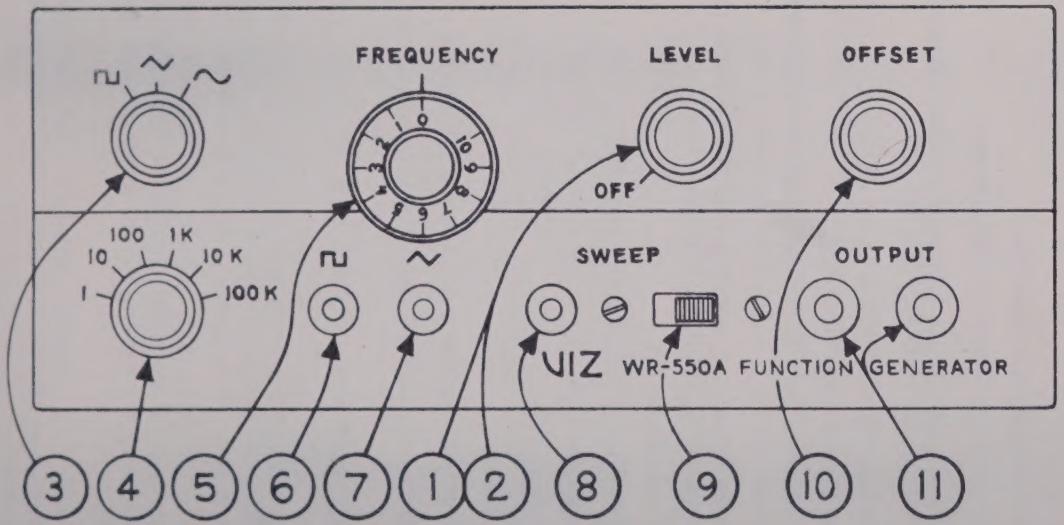
Also available on the front panel is an External Sweep input jack for "Frequency Modulation" of all waveforms. The sweep input voltage (1V to 10V) corresponds to 1X to 10X of the front panel Decade Switch setting.

The frequency range covers 1 Hz to 1 MHz with 200 PPM/°C stability: Sinewave & Trianglewave distortion is less than 2% from 1 Hz to 100 KHz. The Squarewave rise and fall time is less than 100 nsec at 10% to 90% amplitude points, with overshoot and ringing less than 10%.

The WR-550A Function Generator offers without doubt, the most versatility per dollar on the market today.

APPLICATIONS

1. Demonstration of Harmonics in waveforms.
2. Bode Plots, amplitude and frequency characteristics.
3. Radio and Television checkout of some intermediate frequency transformers, FM circuits, audio amplifiers, etc.
4. Active filter checkout and adjustment.
5. Test equipment alignment and calibration.
6. Sweeping to minimize the Lloyd Mirror effect in underwater acoustical systems.
7. Sweeping transfer functions and plotting their characteristics on chart recorders, oscilloscopes, servo systems.
8. Tape recorder head alignment.
9. Frequency response and tone control curve testing.
10. Determination of passive network characteristics.
11. Locating loud speaker resonances.
12. Speaker enclosure tuning.
13. Adjustable clocks for Digital Computers and Microprocessors.
14. Natural resonances in coils, inductors, capacitors and transformers.
15. Exciting mechanical systems and determining their natural frequencies.
16. Testing digital computer input data acquisition systems. For example: testing analog to digital converters (A/D), sample and hold (S/A) amplifiers, multichannel multiplexers and tape recorders.
17. Testing digital computer output data control systems. For example, digital to analog converters (D/A), scope displays and transmission lines.
18. Testing and evaluating ultrasonic transducers for their performance. These would include mechanical, electro-mechanical and optical systems.



FRONT PANEL LAYOUT

Figure 1: Operating Instructions

OPERATING INSTRUCTIONS

1. The Instrument Power Switch is combined with the Level Control on the front panel. When the Level Control is fully counter-clockwise the instrument is turned off. The first 5 to 10 degrees of clockwise rotation turns the function generator on.

2. The Level Control adjusts the amplitude of the selectable output, which is present on the binding posts.

3. The Function Selector Switch selects what waveform will be present on the binding posts.

4. The Decade Factor Switch determines what multiplier you use with the Frequency Vernier Control. For example, when the Decade Switch is in 1K position, the output frequency is the Frequency Vernier knob number times 1000.

5. The Frequency Vernier Control is the fine adjustment of the actual output frequencies, when the Sweep Slide Switch is in the "Internal" position.

6. The output marked ⊓⊔ delivers —.2V to +4V Square waves with rise and fall times less than 100 nsec.

7. The output marked ∿ delivers 4 Vpp Triangle waves centered around zero volts DC.

8. External Sweep Input Terminal.

9. The Sweep Slide Switch selects either External (left hand posision) or Internal (right hand position) Sweep control. With the Slide Switch to the right, internal frequency control is accomplished via the Decade Switch and Frequency Vernier Control. When the Slide Switch is to the left towards the Sweep Jack, external frequency control is accomplished via the applied voltage to the Sweep Jack. The external voltage takes the place of the Frequency Vernier knob. For input voltages between 1 and 10 volts multiply the Decade Switch setting by the actual input voltage. This external mode operates from DC to approximately 100 KHz.

10. The Offset Control permits the operator to adjust the DC level of the actual instrument output signal. The range of adjustment is ±10 volts DC.

11. Output Terminals, for the Switch Selectable Functions, levels and offset voltages.

SPECIFICATIONS

Waveforms:	Sinewave, Triangle wave and Squarewave
Frequency Range:	1 Hz to 1 MHz in six rotary switch selected decade ranges. (Stability ±200 PPM/°C)
Frequency Accuracy:	1 Hz to 100 KHz ±5% of Dial Reading: above 100 KHz ±8% of Dial Reading.
Output Voltages:	Available on the Front Panel are three outputs:
Sinewave:	*Adjustable Amplitude:* 0 to 20 Vpp ±10% with adjustable offset ±10 VDC.
Sinewave Distortion:	1 Hz to 100 KHz. Less than 2%.
Triangle wave:	*Adjustable Amplitude:* 0 to 20 Vpp ±10% with adjustable offset. *Fixed Amplitude:* 4 Vpp centered around 0v dc.
Triangle Linearity:	1 Hz to 100 KHz: less than 2% nonlinearity.
Squarewave:	*Adjustable Amplitude:* 0 to 20 Vpp ±10% with adjustable offset ±10 VDC. *Fixed Amplitude:* —.2 to +4 VDC, ±10%. TTL compatible.
Squarewave Distortion:	1 Hz to 1 MHz less than 100 nsec rise and fall time at 10 to 90% amplitude points. 50% duty cycle, within 150 nsec overshoot and ringing less than 10%. Rise and fall time less than 200 nsec over entire range.
Output Impedance:	Selectable output, 600Ω. Triangle and Squarewave output, 600Ω.

External Input:	Linear external sweep of all waveforms. Sweep input (1V to 10V) corresponds to 1 to 10X of decade switch setting.
D.C. Level:	Front Panel adjustable over entire dynamic range.
Input Power:	105 to 125 VAC, 60 Hz @ 10 Watts.
Operating Temp:	0°C to 50°C; 32°F to 122°F
Size, Weight:	8″ x 5″ x 3″; 2 lbs. 20.32 cm x 12.7 cm x 7.62 cm; 0.9 Kg

THEORY OF OPERATION

The Function Generator consists of five major circuitry blocks:

1. Voltage Controlled Oscillator (VCO)
2. Sine wave shaper
3. Level shifter
4. Output amplifier
5. Power Supply

The VCO provides six decades of operation utilizing a nonlinear, active frequency compensating network.

The Sine shaping network provides a typical incremental linear approximation of a Sine wave.

The Level shifter network, incorporating a unique zener diode biasing scheme, enables total TTL compatibility from DC to 1 MHz.

The output amplifier has a 20 MHz gain-band width product which provides the needed drive capability for 20 Vpp Sine waves at 1 MHz.

The Power Supply is straight forward: It provides transformer isolation from the power line, bridge rectifiers and zener diode regulation for both the ±12 VDC & ±15 VDC.

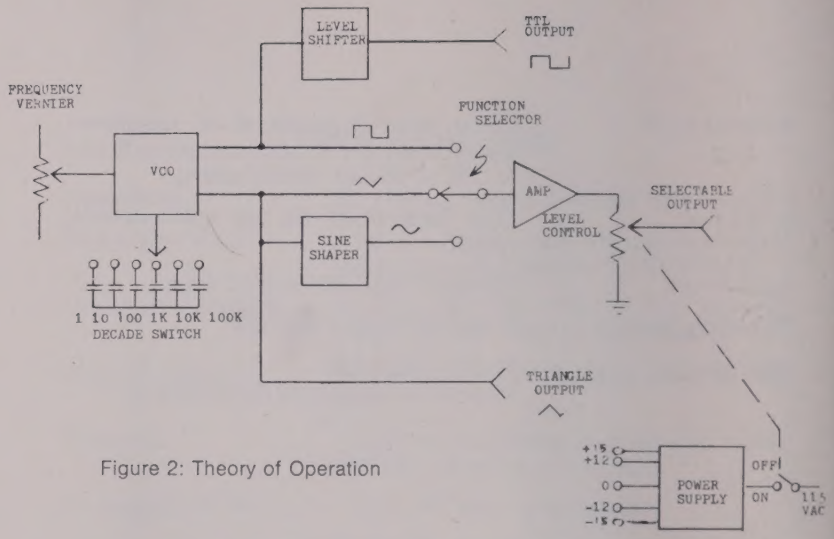


Figure 2: Theory of Operation

CALIBRATION

1. *Caution: While the Function Generator is designed for maximum safety, never lose respect for the high voltage present in this instrument.
2. The only necessary equipment for checkout is an oscilloscope covering the frequency range of DC to 1 MHz. Connect the oscilloscope between the 12R and +12V position. Set the vertical sensitivity switch for 5V/cm.
3. If +12 volts DC is present, then place the scope probe on −12V point and observe this voltage. If the +12V and −12V point readings are within ±10% tolerance, continue on. If not, refer to Figure 5 "Troubleshooting Guide.

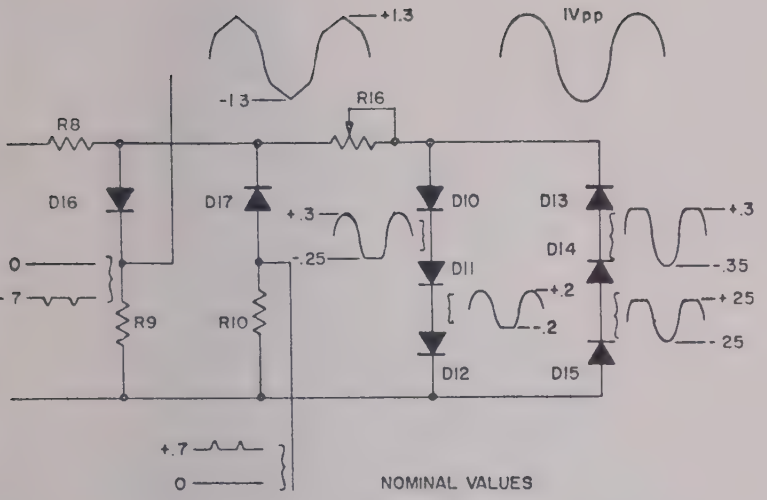


Figure 3

4. Place the scope probe in the R8, D16, and D17 junction, and observe the distorted sine wave. Adjust R17 such that the positive and negative rounding off are identical, see Fig. 3.

5. Turn the frequency vernier R3 to its most CCW position and S2 to its most CW position.

6. Adjust R5 such that the positive and negative rounding off of the distorted sine wave are identical.

7 Place the oscilloscope probe on the lead W6 and turn S3 to its most CW position.

8 Turn R23 (Level and Power Switch) to its most CW position.

9 Adjust R16 for minimum sine wave distortion. The output sine wave should be approximately 18 Vpp.

10. Turn S3 (Function Selector Switch) one position CCW. Observe the triangle output with the scope probe still connected to W6.

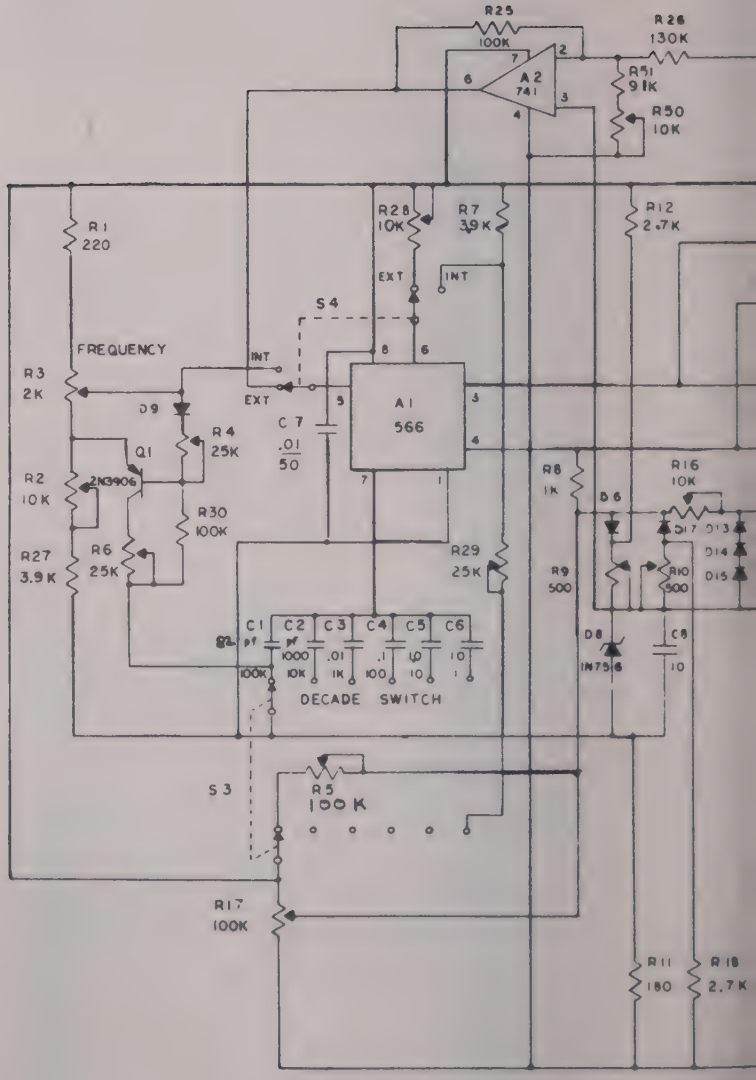
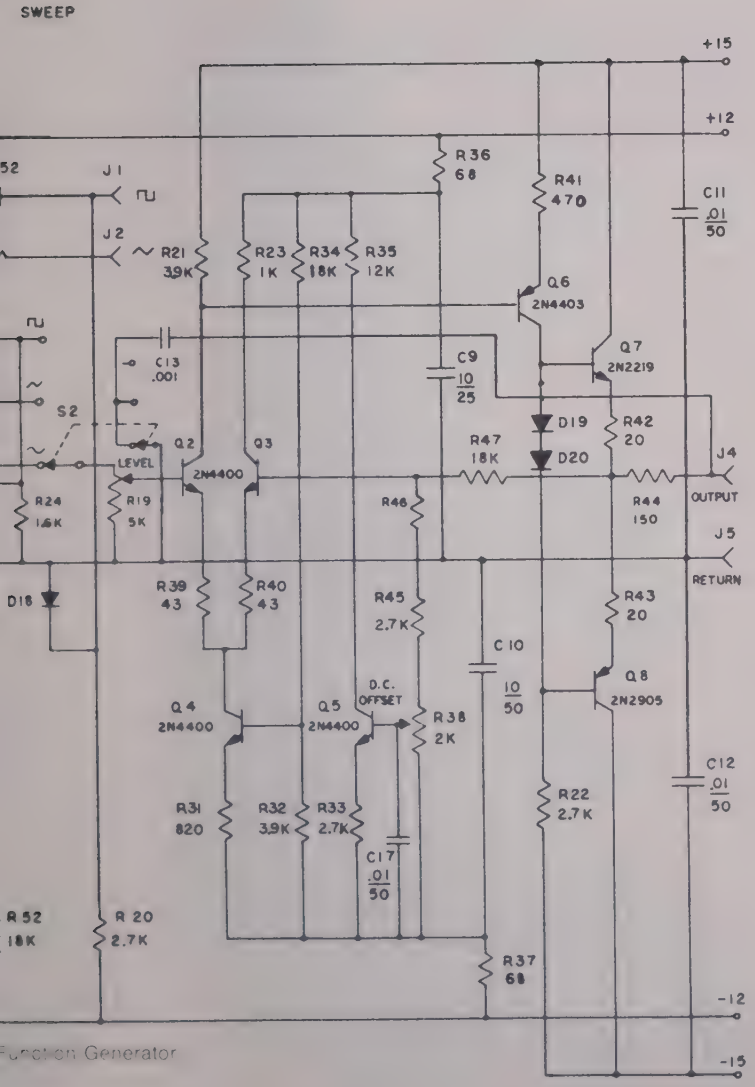


Figure 6: Schem



Function Generator

11. Turn S3 to its most CCW position. Observe the square wave output. Note, the square wave and triangle wave output becomes totally distorted above 500 KHz. This is normal for this instrument since the output amplifier has only a 15-20 MHz gain bandwidth product. To obtain square waves with less than 100 nsec. rise and fall times go to W7 and monitor this output. To obtain triangle waves to 1 MHz go to the triangle wave output W8 and observe this output. Above 100 KHz there is some additional distortion on the triangle wave.

12. See figure 4, to compare the observed with the expected wave forms.

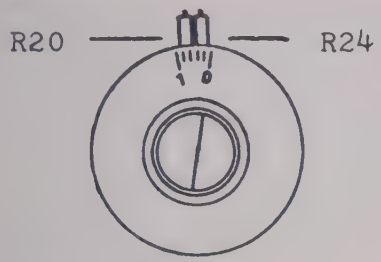
Output Connection	Triangle Output	Squarewave Output	Sinewave Output
W6			
W7	NA		NA
W8		NA	NA

Figure 4: Expected waveforms at 500 KHz

While an oscilloscope can be used to calibrate Function Generators, it is more easily accomplished with a digital frequency meter. In the discussion to follow the abbreviation F M will refer to a frequency meter.

10. Connect the F M circuit to either W6 or W7 and the F M return to W3.

1.1 Turn the Frequency Vernier control fully counter clockwise. Place the frequency vernier knob (K1) on such that the space between R20 and R24 lines up as shown in the figure below. Note it is important that the knob line up as shown below when in the most CCW position.



1.2 Set decade switch (S2) to 1K position. This is accomplished by turning S2 to its most CCW position and then counting off three steps in the CW rotation.

1.3 Turn the Frequency Vernier control (R3) to 5.00 position and measure the frequency on the F M. Then turn R3 to 6 00 position and measure the frequency. Adjust R2 such that the difference is 1.00 KHz (repeat until satisfied).

1.4 Adjust the lower frequency point by setting the Frequency Vernier knob.

1 5 Check the upper frequency point by setting the Frequency Vernier control to 10.00 and measure the actual frequency. Repeat steps 1 3 and 1.4 until satisfied. The maximum acceptable error is ±5% of dial reading.

1 6 Set the decade switch (S2) to its most CW position.

1 7 Set the frequency vernier control to 10.00 position.

1 8 Turn R4 such that the output frequency being measured is a maximum.

1 9 Adjust R6 so that the output frequency is 950 KHz.

1.10 Now, set the frequency vernier to 5.00 and adjust R4 so that the output frequency is 480 KHz.

1.11 Turn the decade switch through all its positions and check the output frequencies. All readings should be within ±5% of vernier setting.

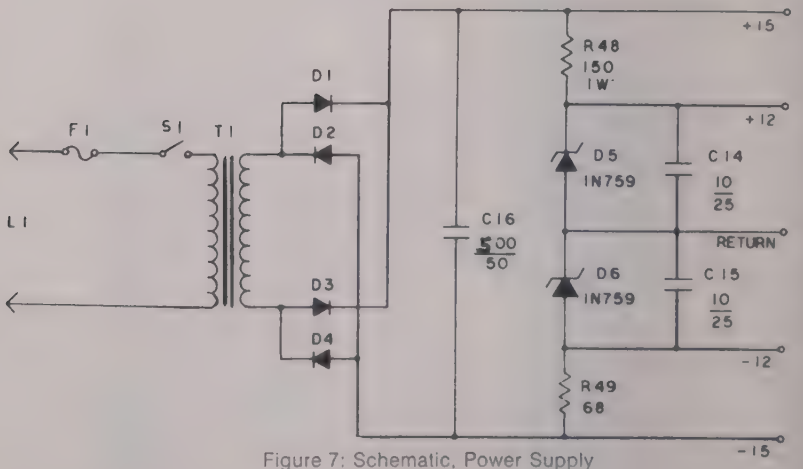


Figure 7: Schematic, Power Supply

TROUBLESHOOTING GUIDE

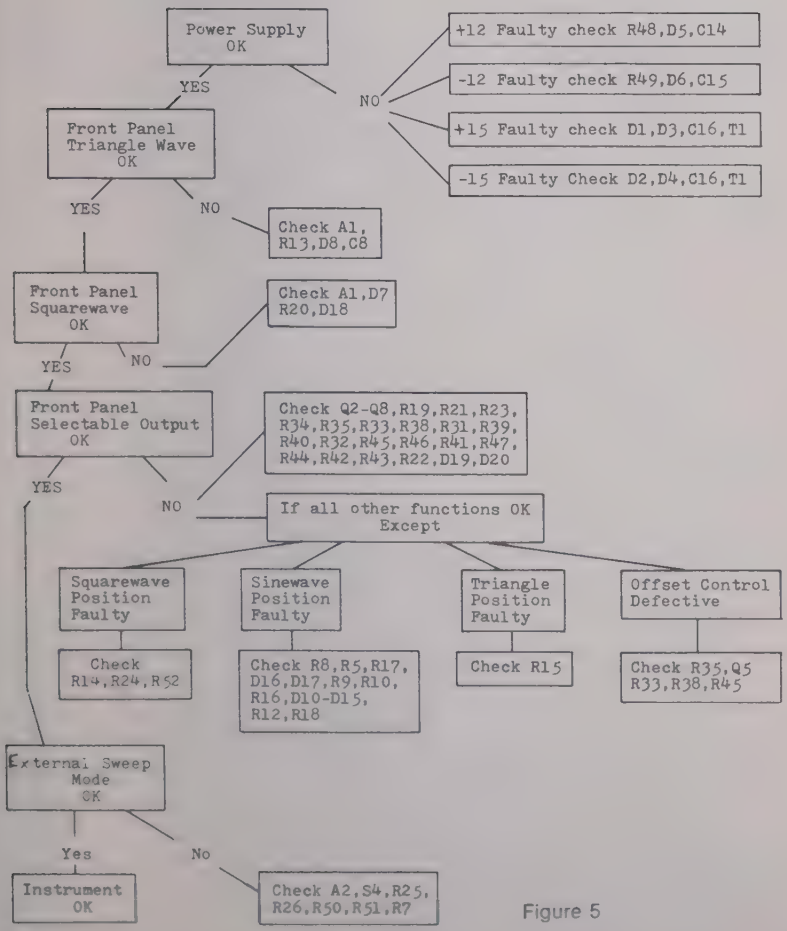


Figure 5

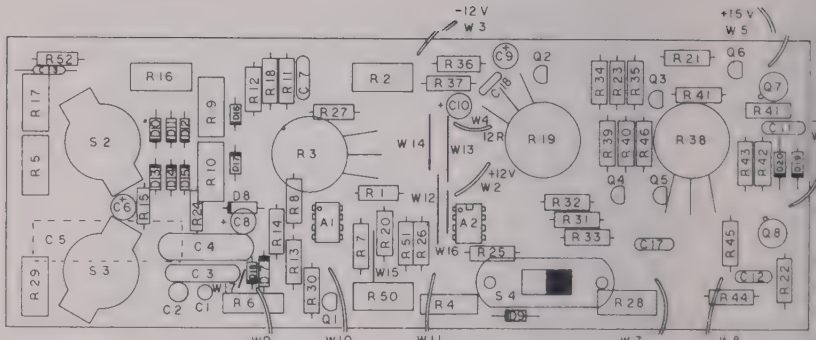


Figure 8

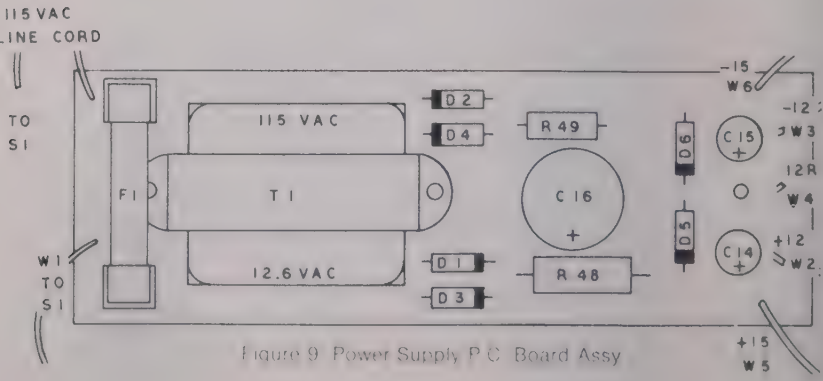


Figure 9 Power Supply P C Board Assy

FUSE REPLACEMENT

Caution:

This instrument is equipped with a three-wire power cord which connects the metal case and ground lead to the powerline ground. To prevent lethal shocks or equipment damage when servicing equipment equipped with a three-wire servicing cord, ALWAYS ELECTRICALLY ISOLATE SUCH EQUIPMENT WITH AN ISOLATION TRANSFORMER, such as VIZ WP-25A, WP-26A, or WP-27A Isotap.

To take the instrument out of the case, remove the screws on the bottom and sides of the case.

Replace the fuse, with the current and voltage rating as listed in the Replacement Parts List.

VIZ REPAIR SERVICE

Authorized VIZ Service Depots throughout the United States are available for repair and calibration of VIZ Electronic Instruments. For up-to-date listings of these depots, contact your VIZ Distributor, or write to VIZ, Electronic Instruments, 335 E. Price St., Phila. Pa., 19144. If it becomes necessary to service this equipment, fill out the Test Equipment Service order form supplied with the instructions:

1 Pack the test equipment carefully. The instrument should be double-packed. It is best to pack the unit in its original carton, or similar container, then "float" this carton in at least a 3-inch layer of suitable packing, such as shredded paper, inside the outer carton.

2 A full description of the problem should be included in the request.

3 Include all probes, cables, and test leads used with equipment.

Attention to these details will help prevent damage in transit and delay in repairs.

REPLACEMENT PART POLICY

It is VIZ's policy to make replacement parts available to its customers at the least cost and as quickly as possible. All items where a part number is listed in BOLD FACE are available from your local VIZ Distributor. Please use the VIZ part number when ordering.

REPLACEMENT PARTS LIST

Symbol No.	Description	Stock No.
	Resistors	
	5% unless otherwise specified, Carbon Film, ½ Watt.	
R1	220Ω	16-222210
R2, R16, R28, R50	10KΩ Control	**9451-2**
R3	2KΩ Control (Frequency Vernier)	**9451-3**
R4, R6, R29	25KΩ Control	**9451-4**
R5, R17	100KΩ Control	**9451-5**
R7, R21, R27, R32	3.9KΩ	16-223920
R8, R23	1KΩ	16-221020
R9, R10	500Ω Control	**9451-8**
R11	180Ω	16-221810
R12, R18, R20, R22		
R33, R45	2.7KΩ	16-222720
R13	620Ω	16-226210
R14	9.1KΩ	16-229120
R15, R35	12KΩ	16-221230
R19	5KΩ Control (Level Pot)	**9451-14**
R24	1.6KΩ	16-221620
R25, R30	100KΩ	16-221040
R26	130KΩ	16-221340
R31, R46	820Ω	16-228210
R34, R47, R52	18KΩ	16-221830
R36, R37, R49	68Ω	16-226800

Symbol No.	Description	Stock No.
	Resistors	
R38	2KΩ Control (Offset Pot)	**9451-21**
R39, R40	43Ω	16-224300
R41	470Ω	16-224710
R42, R43	20Ω	16-222000
R44	150Ω	16-221510
R48	150Ω 1 watt 5%	16-251510
R51	91KΩ	16-229130
	Capacitors	
C1	82 pf 5%	17-108210
C2	1000 pf 5%	17-101030
C3	.01 μf 5%	9451-30
C4	.1 μf 5%	9451-31
C5	1.0 μf 5%	9451-32
C6, C8, C9, C10		
C14, C15	10 μf, 25v electrolytic	9451-33
C7, C11, C12, C17	.01 μf 100v ceramic	9451-34
C13	.001 μf 100v ceramic	9451-35
C16	500 μf 50v electrolytic	9451-36
	Diodes	
D1, D2, D3, D4	1N4002	11-400200
D5, D6	1N759	11-075900
D7	1N752	11-075200
D8	1N756	11-075600
D9, D16, D17, D19, D20	1N4148	11-414800
D10, D15, D18	1N270	11-027000
	Transistors	
Q1, Q6	2N4403 or 2N3906	12-039060
Q2, Q3, Q4, Q5	2N4400 or 2N3904	12-039040
Q7	2N2219	12-022190
Q8	2N2905	12-029050

Symbol No.	Description	Stock No.
	Integrated Circuits	
A1	566CN	14-005660
A2	741DN	14-007410
	Switches	
S1	S.P.S.T. PWR Switch (located on R19)	**9451-14**
S2	4 pole—3 position switch	**9451-50**
S3	2 pole—6 position switch	**9451-51**
S4	2 pole—2 position slide switch	9451-52
	Transformer	
T1	25.2 VAC RMS sec.	**9451-53**
	Misc. Components	
K1, K2, K3, K4	ALCO #PK50 knob	9602-31
B1	Binding Post—Red	9200-126
B2	Binding Post—Black	9200-127
F1	.25 amp fuse	9451-54
H1, H2	Fuse Clips	9451-55
J1, J2, J3	Banana Jacks	9451-56
K5	Frequency Vernier Knob	9451-57
PC1	Power Supply P.C. Board assy.	9451-58
PC2	Main Board P.C. Board assy.	9451-59
V1	Cover	9451-125

All other items listed are standard parts available at most Electronic Distributors. Please order these parts by the description as listed, from your distributor.

THIS BOOK BELONGS TO:

NOTES:

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